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Closing the educational gap for first generation learners: an exploratory study of interactive learning for underprivileged children in India

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Abstract

Previous research studies have indicated that interactive tools where information is presented through computer mediated technology using elements like text, still images, graphics, animation, video, audio, etc., increase student performance as students (men and women) give more attention and enjoy lessons taught with interactive tools. In India, an increasing number of students belonging to disadvantaged classes withdraw from schools due to a lot of contributing factors such as inability to afford education, disinterest of parents, access to transportation, etc. This study, by applying a mix-methods approach, explores the potential of an interactive learning prototype of a website, in increasing engagement, retention and learning level of grade 4 students who are first generation students. In-class observation and semi-structured interviews, tests, and a questionnaire were used as instruments to collect qualitative and quantitative data from 58 participants. Two types of groups, experimental and control, were examined in the Environmental Science and Maths classes. Experimental groups were taught with the website while control groups were taught in a traditional class. Results show the average test scores of experimental groups in both the subjects to be higher than the control groups. Students preferred learning through interactive tools with colourful images and animations.

Keywords: interactive teaching and learning; interactive learning for primary school; first generation learners; India; disadvantaged classes; equity; interactive technology for learning.

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Cerrando la brecha educativa para estudiantes de primera generación: un estudio exploratorio sobre aprendizaje interactivo para niños de bajos recursos en la India

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Extracto

Algunas investigaciones en el campo de la educación asistida por ordenador señalan que herramientas interactivas, donde la información se presenta a través de recursos digitales, tales como texto, imágenes fijas, gráficos, animaciones, vídeo, audio, etc., aumentan el rendimiento de los estudiantes (hombres y mujeres), ya que estos prestan más atención y disfrutan más de las lecciones impartidas con herramientas interactivas. En la India, un número creciente de estudiantes pertenecientes a clases desfavorecidas abandonan las escuelas debido a una serie de factores que contribuyen a ello, como la incapacidad para costear la educación, la falta de interés de los padres, el acceso al transporte, etc. El presente estudio explora el potencial de un prototipo de aprendizaje interactivo de un sitio web para aumentar el compromiso, la retención y el nivel de aprendizaje de estudiantes de cuarto grado, que son, a su vez, estudiantes de primera generación. El estudio emplea una metodología mixta en la que se utilizaron la observación en clase, las entrevistas semiestructuradas, pruebas y un cuestionario como instrumentos para recopilar datos cualitativos y cuantitativos de 58 participantes. Se examinaron dos tipos de grupos, experimental y de control, en las asignaturas de Ciencias Ambientales y Matemáticas. A los grupos experimentales se les enseñó a través del sitio web y a los grupos de control a través de una clase tradicional. Los resultados indican que las puntuaciones promedio de las pruebas de los grupos experimentales en ambas materias fueron más altas que las de los grupos de control. Los estudiantes prefirieron aprender a través de herramientas interactivas con imágenes coloridas y animaciones.

Palabras clave: enseñanza y aprendizaje interactivo; aprendizaje interactivo en la escuela primaria; estudiantes de primera generación; India; clases desfavorecidas; equidad; tecnología interactiva para el aprendizaje.

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Summary

Nota: las autoras del artículo declaran que todos los procedimientos llevados a cabo para la elaboración de este trabajo de investigación se han realizado de conformidad con las leyes y directrices institucionales pertinentes. Asimismo, las autoras del artículo han obtenido el consentimiento informado (libre y voluntario) por parte de todas las personas intervinientes en este estudio de investigación.

1. Introduction

The COVID-19 pandemic has led to the closure of schools which in India alone has impacted the education of approximately 290 million children (Chaturvedi, 2020). Even as technology becomes more affordable, allowing us to maintain a routine in life, the «digital gap» between the rich and poor remains. According to the ASER report (ASER Centre, 2021) the percentage of dropout students in the age group of 6-10 years have sharply increased from 1.80 % (2018) to 5.30 % (2020). Children belonging to lower economic strata who already faced hardship in attending school and earning an education ended up leaving their studies because of being unable to access digital resources when schools started online classes. Learning levels of children from lower income groups studying with traditional textbooks have suffered severely due to limited access to digital devices and lack of proper guidance from parents at home. According to a Key Indicators of Household Social Consumption on Education 2017-2018 report, fewer than 15 % rural households have access to the internet in India (Chaturvedi, 2020; Ministry of Statistics and Programme Implementation, 2019). The percentage of children who could recognize alphabets studying in primary level belonging to 17 districts in West Bengal were 34.40 % (grade 1), 27.20 % (grade 2), 20.70 % (grade 3) and 14 % (grade 4) respectively (ASER Centre, 2021).

Modern education and communication environments offer alternative methods in the learning process. Teaching methods have evolved from traditional face-to-face teaching to Computer Based Learning (CBL) or e-learning systems due to advancements in technology (Cogill, 2003), but Indian schools often fail to invest on the training and development of teachers. As a result, teachers are unqualified to use new technologies and interfaces which has made the transition to online classes difficult for them and schools. To create new programs using multimedia elements and multimedia authoring tools more efforts are needed to fulfil a content-rich learning environment (Nusir *et al.*, 2012).

The percentage of children who could recognize alphabets studying in primary level belonging to 17 districts in West Bengal were 34.40 % (grade 1), 27.20 % (grade 2), 20.70 % (grade 3) and 14 % (grade 4) respectively

Learning materials can be presented through computer-based media in accordance with student learning needs to convey the content of the lesson, providing student learning exercises (Rachmadtullah *et al.*, 2018), including innovative approaches for teaching mathematics (Argüelles Cruz *et al.*, 2023). Technology-enabled education allows teachers to leverage the classroom time engaging students in dynamic activities such as project-based learning (Bourn

and Soysal, 2021; Guamán-Guaya and Cid-Górriz, 2024), peer tutoring, or lively discussion with students mastering core skills on the computer (Sinha, 2011). That being said, not many programs that consider students' socio-economic background and competence of teachers in using technologies have been developed, with some exceptions such as the Head Start Early Childhood Education evaluation (Shager *et al.*, 2013). Thus, further exploration is needed from a different perspective and the current study attempts to explore this topic through an iterative design process, with an interactive prototype as outcome.

2. Objective

The overall objective of this study is to evaluate whether an interactive learning environment improves learning performance of children coming from lower socio-economic backgrounds who are first generation learners and were out of school due to COVID-19 pandemic. To achieve this aim a prototype of an interactive learning website was designed in the regional language of Bengali for primary school students. The website was used to take classes on the subjects Environmental Science and Maths of grade 4 students. The study included 58 participants: two experimental groups consisting of 28 students who were taught using the website, and 3 teachers; and two control groups consisting of 24 students where the children were taught through a traditional class, and 3 teachers. The website was designed with the aim of being an engaging and interactive experience for students who lost touch with studies for almost two years.

The main research questions which guided this study are:

- Does an interactive learning environment help in engagement and increase the learning level of primary school students who are first generation learners?
- What are the students' perceptions of an interactive learning website?
- What is the teacher's perception of using interactive learning?

3. Research methodology

3.1. Research design

In this study two types of groups, experimental groups and control groups were examined. The experimental group was compared with the traditional groups to determine whether the interactive learning website increased the performance level of students. The performance level, engagement and perception about the interactive tool of the experimental group was measured both qualitatively and quantitatively.

3.2. Participants and sampling

The sampling technique used for this experiment was convenience sampling (Stratton, 2021). The criterion to be a participant in this study was the students had to be first-generation learners of primary level and teachers who taught primary grades in a school. A total of 58 participants were part of the study from different backgrounds with students in the age range of 10 to 11 years and teachers in the age range of 29 to 45 years. Among the teachers there were 4 females and 2 males. The education level of teachers varied with most of them completing a college education, the minimum qualification being high school education. Students consisted of 33 males and 19 females. Participants were randomly selected for experimental and control groups. Table 1 displays the distribution of participants in the study.

Table 1. **Number of participants by class and role**

Class	Group	Participants
Environmental Science	Experimental (N = 20)	School students of grade 4 (N = 18) Teacher (N = 2)
	Control (N = 17)	School students of grade 4 (N = 15) Teacher (N = 2)
Maths	Experimental (N = 11)	School students of grade 4 (N = 10) Teacher (N = 1)
	Control (N = 10)	School students of grade 4 (N = 9) Teacher (N = 1)

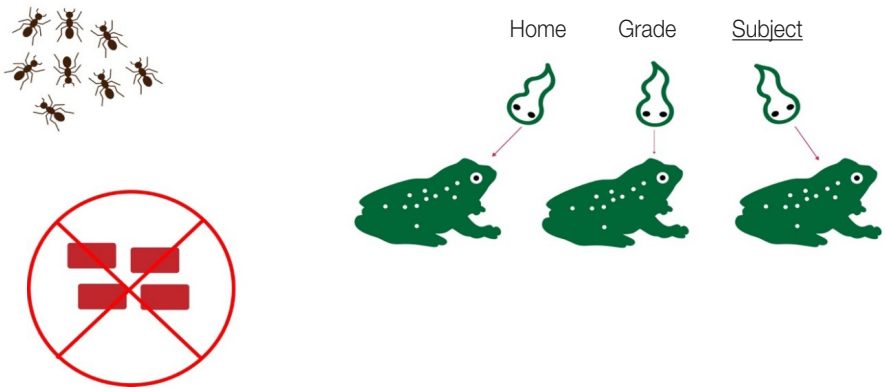
Source: own production.

3.3. Creation of the platform

For this study, a prototype of a clickable website was designed in the regional language of Bengali based on the local curriculum of schools. The material created was for students of grade 4 for Environmental Science class on the topic of «living things» (see figure 1) and Maths class on the topic of «measurement scales». The website was designed in the design software Figma. The content of the website was made lively with visuals elements like

animations, illustrations and images instead of textual as seen in school textbooks. Unlike a traditional class the dissemination of knowledge was not a one-way process. The learning was interactive where students were asked to solve a question on the screen after a portion of the topic was explained by the teacher. The quizzes/tasks tested whether students could relate words with pictures so that concepts get registered in their minds. For example, in «living things» students were given the task of completing a food chain by selecting the appropriate picture of an animal in the blank space. The teacher proceeds ahead with the website pages only after a student has correctly answered a quiz question. Students interacted with the screen by click of the mouse. The interactions were simple as the target users of the website are first generation learners who have never used computers or touch screen smartphones prior to the class. This was useful to better understand if simple interactions help learn the topic better for such students whose digital literacy is very limited.

Figure 1. **Screenshot of the website page**



Source: own production.

3.4. Instruments

Four instruments were used in this study: in-class observation, semi-structured interviews, tests, and a questionnaire. Observations of participants of experimental and control groups were used for understanding their behaviour during class, their interaction with the website, and to understand how the platform works as an educational tool. Field notes and video recording were used. A common topic was given to the teachers of both experimental and control groups to take a class on. The students of the experimental group solved quizzes during the class which gave them a chance to interact with the website.

Semi-structured interviews were conducted to understand users' (students and teachers) perceptions of interactive learning and to collect feedback about the platform. The questions were open-ended questions, from broad categories to achieve comprehensive qualitative data on interactive learning and its effectiveness as an educational tool for first generation learners. Teachers and students were questioned about their background, context of COVID-19, impressions and perceptions about using technology as an educational tool. Teachers were also asked about their personal usage of technology and how technology can benefit students of lower socio-economic status. After class, teachers who taught the experimental groups were asked about their experience with using the website to collect feedback about the validity of the website as an interactive learning tool. Additionally, students in the experimental group were asked to give feedback on their experience of attending a class with the website.

Tests were to determine if the website was successful in increasing the performance level of students. The test for the Environmental Science class consisted of questions from the topic «living things». There were 7 questions in the test paper and the total score that could be achieved was 20. The questions in the test consisted of identifying different living organisms, the different habitats they live in, differences and similarities between organisms. Though the test questions consisted of learning material, they were not directly taken from the school textbooks. For the Maths class, the test consisted of 5 questions from the topic «measurement scales» where the students could achieve a maximum score of 20. The questions tested students' ability to measure common items like a school bag, book, house keys, etc., with a measuring scale. The test questions in both the subjects had visual elements, consisted of images and were not text heavy, like the content of the website taught in the class.

The questionnaire was provided to the teachers and students of the experimental group after class, and it was adapted from Çetin (2018) and Nikolaidou (2021). It consisted of 9 questions for the students' version and 11 questions for the teachers' version. The questionnaire measured opinions of users on the website on a 5-point Likert scale (1 = completely disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = completely agree). Questions consisted of the usability of the website such as «I found the website unnecessarily complex», on the aesthetics of the website such as «I felt very confident using the website», and on the website as an educational tool «The class material provided was helpful in understanding the topic».

3.5. Data analysis

Observations and semi-structured interviews were analysed qualitatively. Thematic analysis was conducted to analyse the data, extracting codes and themes from the data. Similar patterns and insights from the interview emerged but they were necessarily informed by the type of questions in the interview. All the data was coded manually. Results were informed

by the emerging common themes, attitudes and perceptions. Tests and questionnaires were quantitatively analysed. Descriptive statistics, mainly mean scores and standard deviation, were used to calculate the test scores of the experimental and control groups. Results from the questionnaire were also analysed using descriptive statistics by means of percentages. Data from the different sources were combined and compared to find connections between the data and useful trends. Qualitative data explained similar behaviours, patterns and trends whereas quantitative data recorded the performance level of students, their attitudes. This triangulation of data helped rich insights to emerge.

4. Results

Qualitative data was collected in the form of observations and semi-structured interviews with the participants of the study.

For the Environmental Science class the observation was in class but for the Maths class it was conducted online as a precaution after the third wave of COVID-19. Observation helped identify common elements in behaviour of students, their interaction in class and their interaction with the interactive platform. The observation revealed following patterns:

- Teachers who have experience with using technology were comfortable using the website.
- Teachers who did not use a laptop prior to the class initially were a bit uncomfortable with the idea but after a while got relaxed taking a class using the laptop.
- Children were excited seeing the interactive elements and were thoroughly engaged in the class.
- Children in the traditional class were not that attentive in class and many of them had blank expressions while listening to the teacher taking the class.
- Most of the participants faced problems with the navigation elements which were clearly identifiable.
- Most of the children while interacting with the website initially were hesitant using technology but gained confidence and were eager, intrigued to use the website.
- Children after answering a correct answer needed encouragement shown on the screen through visual elements.

Thematic analysis was done on the data from interview transcripts and notes to extract similar patterns and insights and categorise them into codes. The codes were combined into higher level themes. The key themes were defined and explored in detail to define their meaning in order to find useful and informative insights, and how they apply in

understanding the data for the research study. The data was then written up to provide conclusions and results. Key themes which emerged from the data analysis of the semi-structured interviews were:

- Visualisation is helpful for understanding.
- Children need a stimulating environment.
- Attraction to visual content.
- Engaging with technology.

Table 2. **Codes obtained after thematic analysis**

Environmental Science class	Maths class
Visualisation helps to study.	Interest in playing games on mobile phones.
Pandemic made children lose interest in studies.	Playing with friends.
Background affects children's studies.	Watching cartoons.
Children are unable to utilise their potential.	Animation is likeable.
Teachers have to make children learn through playing.	Learning to use mobile phones.
	Playing all the time.
	No discipline at home.

Source: own production.

Participants expressed that visualisation helps in remembering and understanding (Yip and Kwan, 2006).

One teacher said «The website lets you collect information as well as visualise it. Having a screen helps you. Everyone does not have artistic skills which prevents showing or drawing exactly what I want or shown in the book». T1[1]/Environmental Science class. Another teacher reflected «The children were able to see in front of them what I was explaining. In a regular class I used to talk about the things which they were not able to see». While a student said «It was better than studying with books. I liked the pictures of trees, birds».

[1] T stands for teacher.

COVID-19 pandemic has affected the studies of children, and they are unable to remember materials taught to them prior to pandemic. All the teachers were of the same opinion that children coming from hard socio-economic backgrounds are unable to utilise their full potential as they do not have discipline or guidance from parents who themselves do not have demand for studies. T2/Environmental Science class commented «Parents don't have demand for studies». T3/Environmental Science class mentioned «They have minimal interest in studies. We have to forcefully teach them through games so sometimes we let them play and not force them. Through playing we teach them sometimes like counting numbers. They then learn these things quickly». Another teacher said «They are studying just for the sake of it. Earlier they wanted to achieve high scores in the classes because of competition amongst each other, which is lacking now».

All the teachers were of the same opinion that children coming from hard socio-economic backgrounds are unable to utilise their full potential as they do not have discipline or guidance from parents who themselves do not have demand for studies

Even before the pandemic they had very little interest in studies where they played most of the time. According to teachers' children have lost interest in studies completely and they are attending classes only because they must, without eagerness to study. As for the visual content, all the children were attracted to the visual content such as animations and pictures transformed their experience of a classroom into an enriching experience compared to traditional classroom (Kennewell and Morgan, 2003). S1[2]/Environmental Science class mentioned «The pictures were moving so I liked it more». Teachers agreed with the opinion of students saying «In their classes students are taught everyday via the writing board. There is nothing interesting about it.

On the website they are getting something interesting through audio visuals and they are putting more effort into learning I think». T2/Math class. Children use mobile phones for watching cartoons, playing games or listening to music without the help of someone. As a S14 of Environmental Science said, «I play games, watch cartoons». They are made to study by their teachers or parents, but they willingly use a phone/tv which they learned to use out of sheer curiosity.

Quantitative data was collected through tests conducted on the topic taught after class and questionnaires. The same material was taught to both the experimental and control groups consisting of grade 4 students. Table 3 shows the comparison of average scores of the two groups in the Environmental Science class and Maths class.

[2] S stands for student.

Table 3. **Comparison of average scores of two groups in the Environmental Science and Maths class**

	Environmental class		Maths class	
	Mean	SD	Mean	SD
Experimental group	12.30	8.03	8	0.60
Control group	5.48	5.99	1.41	0.56

Nota. SD stands for standard deviation.

Source: own production.

For the Maths class students in the experimental and control groups were taught the chapter measurement scales. The table compares the scores of the experimental group taught with the website and the control group taught through a traditional class.

Results in table 3 show a positive impact of using interactive tools as an educational tool. This is seen in the average scores in both the Environmental Science class and Maths class. The scores were extremely scattered in both the groups of Environmental Science class. The highest score achieved was 20 and the lowest score was four in the experimental group. In the control group the highest score achieved was 18 whereas the lowest score fell to zero. But this can be seen improving a bit in the main study where the standard deviation in the experimental group was very little with students scoring similar marks. The performance of the control group in the Maths class was really poor with a very low mean score (the highest and lowest score was 2 and 0 respectively). The reason for this can be attributed that subject Maths was tested in which students struggle understanding in the Indian subcontinent, where the education system focuses on rote learning which refers to learning by memorization or continuous repetition and does not involve conceptual learning where learning is acquired by understanding of concepts as huge preference is given to achieving high marks in examination but not meaningful gain of knowledge (Kundu, 2018; Ramya, 2012). This educational system follows the «factory model» created between the 18th and 19th century for Indians by the colonial British government to suit the needs of the Industrial Revolution. This educational system fails to focus on conceptual learning and practical knowledge (Ramya, 2012).

A questionnaire was given to participants (students and teachers) of the experimental groups in the pilot and the main research study after attending a class done with the website. 8 students of the Environmental Science class in the experimental groups and 10 students of the Maths class in the experimental group answered the questionnaire after attending a class with the website.

Table 4. **Students' perceptions towards the website (Environmental Science class)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q1. The website was easy to use.	0%	0%	0%	12.50%	87.50%
Q2. I think the website is informative.	0%	0%	0%	0%	100%
Q3. I think the website is enjoyable.	0%	0%	12.50%	0%	87.50%
Q4. I have got a better understanding of the subject after I have used the website.	0%	0%	0%	0%	100%
Q5. The class material provided was useful in understanding the topic.	0%	0%	12.50%	0%	87.50%
Q6. The activities stimulated my learning.	0%	0%	0%	0%	100%
Q7. The quality of material content like image, animation is excellent.	0%	0%	12.50%	0%	87.50%
Q8. The text of the website was easy to understand.	0%	0%	25%	0%	75%
Q9. I can still remember the topic taught after class was over.	0%	0%	12.50%	0%	87.50%

Source: own production.

Table 5. **Students' perceptions towards the website (Maths class)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q1. The website was easy to use.	0%	20%	60%	0%	20%
Q2. I think the website is informative.	0%	0%	0%	0%	100%
Q3. I think the website is enjoyable.	0%	0%	0%	0%	100%
Q4. I have got a better understanding of the subject after I have used the website.	0%	0%	0%	0%	100%
Q5. The class material provided was useful in understanding the topic.	0%	0%	0%	0%	100%

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q6. The activities stimulated my learning.	0%	0%	0%	0%	100%
Q7. The quality of material content like image, animation is excellent.	0%	0%	0%	0%	100%
Q8. The text of the website was easy to understand.	0%	0%	0%	0%	100%
Q9. I can still remember the topic taught after class was over.	0%	0%	0%	0%	100%

Source: own production.

The website had favourable ratings among both the Environmental Science and Maths group on its usability and as an educational tool (see tables 4 and 5). The quality of aesthetic elements of the website, like text and content material, had positive ratings among students. Two teachers from the experimental group of the Environmental Science class and one teacher of the Maths class answered the questionnaire after they took a class with the website. Tables 6 and 7 show the responses of teachers to each question of the questionnaire.

Table 6. **Teachers' perceptions towards the website (Environmental Science class)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q1. I can use the website easily.	0%	0%	0%	50%	50%
Q2. I think I will use the website frequently.	0%	0%	50%	0%	50%
Q3. I found the website unnecessarily complex.	100%	0%	0%	0%	0%
Q4. I felt very confident using the website.	0%	0%	0%	100%	0%
Q5. I think I would need the help of a technical person.	50%	50%	0%	0%	0%
Q6. I needed training to use the website.	50%	50%	0%	0%	0%

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q7. I think that most people will learn to use the website quickly.	0%	0%	0%	0%	100%
Q8. The website attracts the attention of students during class.	0%	0%	0%	50%	50%
Q9. The website increases motivation of students.	0%	0%	0%	0%	100%
Q10. The website helps engage students in class.	0%	0%	0%	0%	100%
Q11. The website provides the right amount of theoretical and practical knowledge.	0%	0%	0%	0%	100%

Source: own production.

Table 7. **Teachers' perceptions towards the website (Maths class)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q1. I can use the website easily.	0%	0%	0%	0%	100%
Q2. I think I will use the website frequently.	0%	0%	0%	0%	100%
Q3. I found the website unnecessarily complex.	0%	0%	0%	0%	100%
Q4. I felt very confident using the website.	0%	0%	0%	0%	100%
Q5. I think I would need the help of a technical person.	100%	0%	0%	0%	0%
Q6. I needed training to use the website.	100%	0%	0%	0%	0%

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
◀					
Q7. I think that most people will learn to use the website quickly.	0%	0%	0%	0%	100%
Q8. The website attracts the attention of students during class.	0%	0%	0%	0%	100%
Q9. The website increases the motivation of students.	0%	0%	0%	100%	0%
Q10. The website helps engage students in class.	0%	0%	0%	0%	100%
Q11. The website provides the right amount of theoretical and practical knowledge.	0%	0%	0%	100%	0%

Source: own production.

Teachers of both Environmental Science and Maths classes had positive opinions about the website. All the teachers in Environmental Science class strongly agreed that the website was engaging, motivating for the students and provided the right amount of theoretical and practical knowledge. The teacher in the Maths group gave positive ratings on the capabilities of using the website and thought the website was an effective educational tool.

5. Discussion

Results discussed in the previous section show that interactive learning has a positive impact on children who are first generation learners coming from hard socio-economic backgrounds where COVID-19 kept them out of school for two years.

The initial results from the Environmental Science class showed the similarity of having large standard deviation of scores from the mean in both the groups, implying that the interactive

The initial results from the Environmental Science class showed the similarity of having large standard deviation of scores from the mean in both the groups, implying that the interactive website was effective in increasing performance levels of some students much more compared to others who did not seem to benefit from it

website was effective in increasing performance levels of some students much more compared to others who did not seem to benefit from it. The positive results from the Maths class where the students of the experimental groups outperformed the students of the control groups with overall performance of students scoring high marks shows the effectiveness of the website in increasing learning levels of students impacted by COVID-19 pandemic and are first generation learners.

The pitiful performance of the students of the control group in the Maths class shows the other side of COVID-19 pandemic and exposing the inadequacies of the education system in India. Most of the Indian population resides in rural areas and the highest number of school enrolment is under government schools. The inferior performance of students in these schools can be attributed to teacher absentees, inadequately trained teachers, non-availability of teaching materials and inadequate supervision (Dey and Bandyopadhyay, 2019).

Even though the Indian government has invested in improving school infrastructure to facilitate access to education of underprivileged children, it ignored investments on quality education. As Dey and Bandyopadhyay (2019) mention in their study, this had led to high dropouts of students who were already facing difficulties in acquiring an education. This lack of quality education is reflected in the deficient performance of the students in the control group in the main study where they were tested in Maths.

Though the test questions were from the learning material that was taught, the questions were not directly taken from the exercises in the school textbook. The students could not answer as the majority of their education consists of memorising chapters instead of understanding concepts where children are unable to answer questions which are not from their textbooks.

These thoughts are echoed in Kundu's (2018) study as well, where he points out that modern Indian education is criticised for encouraging rote learning, textbook knowledge, and rigid ideas. Critical thinking, comprehension, problem-solving skills, and logical reasoning essential for Maths learning, takes a backseat to textbook knowledge, rigid ideas and test scores. As Rochelle *et al.*, (2000) indicate that every nation in the world is disappointed with the mathematical capabilities of their students as the main challenge of mathematics education is teaching sophisticated concepts to a much broader population than traditionally has been taught such material.

This is evident from the results of the Maths class where students in the control group performed far below the expected level on the test showing that a traditional way of teaching which applies transmission mode of teaching fails. In the traditional way of teaching the learner has the passive role of

Even though the Indian government has invested in improving school infrastructure to facilitate access to education of underprivileged children, it ignored investments on quality education

receiving information through either textbook or teachers causing students to only memorise scientific mathematical formulas without understanding the concept behind them. Almost all the students in the control group scored the same marks, which were very low.

When learners have fun learning, they are more motivated to learn new and challenging tasks (Hilliard and Kargbo, 2017). This was seen in the test scores of experimental groups where most of the students performed well even in a subject like Maths, compared to the control group as the students in experimental groups were thoroughly engaged in the class and enjoyed it. An interactive learning app can effectively improve a learner's score when applied in the curriculum as seen in Guo and Wu's (2018) study on rural students.

Students of the experimental group taught through a mixed method of traditional teaching and the iPad outperformed the contrast group taught only through traditional methods. Prior research has shown that when learners regularly apply the ideas, they learn in class receiving immediate feedback on the success or failure of an idea, that is when learning proceeds rapidly (Rochelle *et al.*, 2000).

One of the major findings of the study was to see the student's engagement in class and perceptions of interactive learning. Rural students who come from underprivileged backgrounds have poor digital maturity and poor economic conditions which prevent them from possessing electronic devices preventing them to immerse in such technologies compared to their urban counterparts (Dey and Bandyopadhyay, 2019). Students who had access to any electronic devices were quick to adapt and use the website with ease. The visual delivery of the content on the website kept the students intrigued and engaged in the class. By using computers' capacity for simulations, dynamically linked notions and interactivity, ordinary students can master concepts easily (Rochelle *et al.*, 2000).

This was in contrast to the control group where traditional methods of teaching were used which is mainly teacher centric, monotonous and repetitive. The students could not concentrate in a class of mundane textbook experience. The lack of quality primary education in rural areas where most of the students are first generation learners creates the risk of widening of the gap between rural and urban India. Issues of extreme poverty causes acquiring three square meals a day becomes tough, drains the motivation to acquire education and stay in school (Kundu, 2018). Such children need to be captivated and motivated through ingenious learning techniques in school to keep them interested in studies and prevent them from dropping out. This study saw that an interactive website keeps students from a rural area engrossed in the class.

Digital technologies should be integrated in education systems of developing countries in appropriate ways which would help both teachers and learners to accept and adopt digital technologies as new methods of learning (Cross *et al.*, 2014; Dey and Bandyopadhyay, 2019). When COVID-19 pandemic hit, governments around the world turned to EdTech as an immediate response by providing digital devices hoping children would continue using

online platforms at home (Tobin and Hieker, 2021). But students in remote areas and low-income countries experienced digital poverty where they could not access computers, have internet connectivity or supporting learning environments missing out on school for two years.

For children living in poverty, school is more than a place of academic attainment, it is a place of social and emotional learning, protection, community and provision for basic needs such as health and nutrition (Tobin and Hieker, 2021). As such for developing countries like India, technology enabled learning needs to adopt a «blended learning» approach with classes in school setting with elements of virtual education (Kundu, 2018; Tobin and Hieker, 2021). But a complete reliance on technology as a silver bullet for solutions without trained teachers will likely result in an unsuccessful outcome. Technology enabled learning was resisted in India as people saw technology as replacing teachers (Kundu, 2018).

Recognizing teachers as a major part of children's education, the study aimed to see teacher's perception of interactive learning. Most of the teachers were willing to adopt new methods to keep these students engaged and interested in studies. Every teacher believed these students come from hard backgrounds where they lack family support and discipline in their studies. These families are struggling to provide basic necessities and are financially burdened. Such children are not interested in traditional teaching methods and need lively interaction and learning material to keep them engaged in class (Schmitz *et al.*, 2011).

Almost all the teachers agreed that technology can benefit students who are first generation learners but as the government is unwilling to invest and even if there is investment, they are sporadic with teachers not adequately trained and motivated to use innovative teaching aids (Yip and Kwan, 2006). As Rochelle *et al.*, (2000) state in their study, teachers are a major factor in making changes substantially using technology in their teaching style and the curriculum they teach using technology, but teachers need appropriate support and commitment from school administration to make the changes feasible. It would be desirable to have clear and universal measures of strength before committing to continual investment in technology for improving education. Technology is not the solution but part of the solution (Tobin and Hieker, 2021). Technology assisted education should be designed taking the context into perspective (Tembang *et al.*, 2020).

6. Conclusion

The aim of this research study was to see the effectiveness of an interactive learning website to increase performance levels and engagement of students who are first generation learners and were out of school due to COVID-19 pandemic.

The results show the positive impact of the website in increasing the learning levels of the students compared to students in a traditional classroom. Even though the pilot study revealed that some students scored low marks even after attending a class through the website. This difference of marks was a bit lessened in the main study and it proved that the website had positive impacts. The students were satisfied with this innovative learning and teachers also showed preference and positive attitude towards interactive/technology assisted learning.

However interactive learning is not the silver bullet solution to improving the education of these children coming from hard socio-economic backgrounds. Governments should invest in incorporating digital technologies into the classroom keeping in mind the context in which the schools are located, digital maturity of the students, properly training teachers and internet facilities.

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